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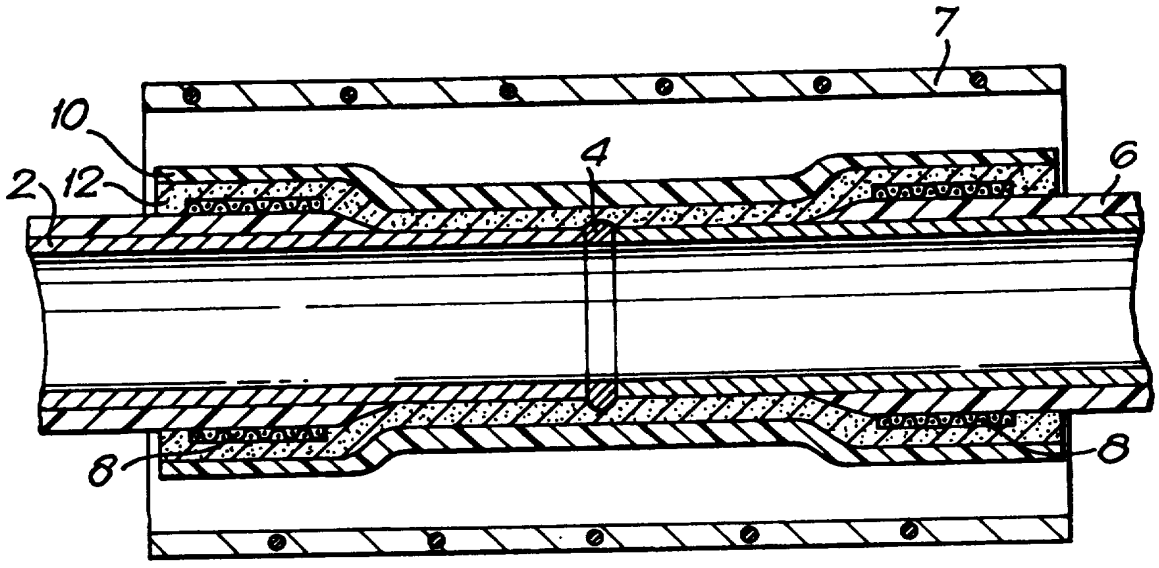

(57) Abstract

A joint (4) between polymeric coated (6) metal pipelines (2) is covered with an adhesive (12) lined heat recoverable sleeve (10) positioned to overlie the coating (6) on either side of the joint (4). Prior to recovery of the heat recoverable sleeve (10) onto the coated pipelines (2, 6) a metallic mesh element (8) is positioned over the pipeline coating (6) on either side of the joint (4). After recovery of the sleeve (10) the entire joint is heated by an induction heater (7) to generate a high temperature not only (i) between the bare pipe (2) in the joint region (4) and the recovered sleeve (10), but also, by means of the mesh element (8), (ii) between the polymeric coating (6) on the pipelines (2) on either side of the joint (4) and the recovered sleeve (10).

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Description

Pipe Joint Covering

This invention relates to a method of covering a joint between coated, metal, pipes which have been bared of coating in the joint region. In particular it relates to methods of covering such joints using an adhesive lined heat recoverable sleeve which is positioned over the bared joint region so that it overlies the coating on either side of the joint, which is then heated to cause it to recover into conformity with the underlying joint and coating, and which is finally subjected to induction heating to heat the covered pipe.

A heat recoverable article is one whose dimensional configuration may be made to change when subjected to an appropriate treatment. Usually these articles recover, on heating, towards an original shape from which they have previously been deformed but the term "heat recoverable" as used herein, also includes an article which, on heating, adopts a new configuration, even if it has not been previously deformed. One manner of producing a heat-recoverable article comprises shaping the polymeric article into the desired heat-unstable form, subsequently cross-linking the polymeric material, heating the article to a temperature above the crystalline melting point or, for amorphous materials the softening point, as the case may be, of the polymer, deforming the article and cooling the article whist in the deformed state so that the deformed state of the article is retained. In use, since the deformed state of the article is heat-unstable application of heat will cause the article to assume its original heat stable shape. In their most common form, heat recoverable articles are heat shrinkable.

It is common practice to use metal pipes (e.g. steel) which have a corrosion protective coating thereon. This coating is usually a thin layer or about 3-5 mm thickness, e.g. extruded polyethylene or polypropylene which is applied to the pipeline in the factory. Such a coating is sometimes referred to as a mill coating or a line coating. Where it is desired to form a joint (e.g. by welding) between such coated pipes, it is usually necessary first to remove the coating at the end of each of the pipes to be joined. After the joint is complete it is then necessary to re-cover the bared, joint region. It is known to do this using an adhesive-coated heat recoverable covering (e.g. sleeve or tape) that is heated, usually by a gas torch, to recover the

covering into conformity with the underlying substrate. It is also known. after recovering the covering to apply induction heating to the covered pipe joint.

Japanese publication 3-244527 describes a method for covering a joint between coated pipes (which have been bared of coating in the joint region) using a heat shrinkable covering material which is positioned over the joint so that it overlaps the coating on either side of the bared joint and which is then shrunk by means of a gas torch into conformity with the underlying pipe and coating. According to Japanese publication 3-244527 an induction heating coil is then positioned around the shrunk adhesive-lined heat-shrinkable sleeve and activated to fusion-bond the adhesive layer of the covering material to the outer face of the pipe.

It is also common practice to pre-heat the surface onto which a recoverable covering is to be recovered. Pre-heating is usually carried out to raise the temperature of the pipe surface to a temperature in the range 5°C above the Dew Point to about 140°C. The purposes of the pre-heating is first to remove moisture, and secondly to facilitate the attainment of an adequately high bond line temperature at the interface between the pipe and the adhesive on the recoverable covering, and between the line coating on either side of the joint and the recoverable covering. Since the pipes are metal they act as a heat sink, and it may be difficult to achieve an adequate bond line temperature merely by the use of heat applied externally of the heat recoverable covering in order to recover the covering. Pre-heating is typically carried out using a gas torch, but may also be carried out using an induction coil.

A number of problems may be experienced in a pre-heating process applied to achieve the appropriate bond line temperature under an adhesive lined recoverable covering material.

Where induction heating is used as the pre-heating method it is not always possible to reach the desired pre-heat temperature on top of the line coating. The reason for this is that the heat is generated in the body of the pipe when an induction heating process is used, and the heat has to transfer through the line coating to the coating's outer surface by thermal conduction. The temperature achievable by induction heating and conduction through the line coating is typically a maximum of about 90°C, while in contrast the bared pipe region attains a temperature of about 200°C by the induction heating. The 90°C temperature on the surface of the line coating may not be adequate for a good bond to some adhesives, or to cause fusion of adhesives to the coating surface where that is required. Where a gas torch is used to

effect the pre-heating, this may damage the top layer of the coating (depending on the nature of the coating), and/or the coating may cool prior to installation of the recoverable covering material. Also some adhesives do not bond well to a flame-brushed surface.

Japanese publication 3-244527, mentioned above, which uses an induction heater after the installation of the covering to fusion-bond the adhesive of the covering to the outer face of the pipe, recognises that the region of the covering overlying the coating on either side of the bared joint is not directly heated by the pipe, and that consequently the temperature rise of the surface of the coating occurs more slowly than that in the bared joint region. To solve this problem Japanese publication 3-244527 suggests that an auxiliary heating means such as a ribbon heater, hot plate heater, or the like, is fitted to the outer face of the covering material over the line coating region. This auxiliary heating means would need to be heated separately from any heat applied to the pipe by induction.

Japanese publication 3-244527 does not describe pre-heating of the pipeline by any method.

The present invention provides a method of covering a bared joint region between pipes which is simple to use, uses a minimum amount of equipment, and achieves a strong bond not only between the bared pipe region and an adhesive lined covering, but also between a line coating on either side of the bared pipe and the adhesive lined covering.

A first aspect of the invention provides a method of covering a joint between coated metal pipes which have been bared of coating in the joint region, comprising positioning an adhesive lined heat recoverable covering over the bared joint region so that it overlies the coating on either side thereof, heating the covering to cause it to recover into conformity with the underlying joint and coating, and after recovery of the covering applying induction heating to the covered joint, characterised in that prior to recovery of the covering:

(i) a metallic element is positioned over the coating on either side of the bared joint region; and

(ii) the heat recoverable covering is positioned so that it overlies both of the metallic elements.

The effect of the provision of metallic elements, on the coating and within the covering, is that when the induction heating is applied, not only the metal pipe, but also the metallic elements between the pipe coating and the adhesive-lined covering are directly heated by the induction heater. Therefore an appropriate bond line temperature may be achieved by the induction heating not only between the bare pipe and the covering, but also between the coating and the covering. This differs from the method described in JP-3-244257, in which a ribbon heater, provided on the outer surface of the covering over the coating, needs to be heated in a separate step to the heating of the pipe surface applied by induction heating.

The heat recoverable covering may be in any suitable form. For example, it may be in the form of a sleeve (open or closed cross-section) or in the form of a tape.

The metallic elements may take any suitable form which allow them to pass heat directly to the interface between the pipe coating and the recoverable covering. Preferably the metallic elements contain apertures which allow direct physical contact, through the apertures, between the pipe coating and the recoverable covering. Preferably the metallic elements comprise a mesh. Preferably the apertures in the mesh have a surface area in the range 1-20cm^2 especially 1-10cm^2. The apertures in the mesh are preferably square or diamond-shaped.

Preferably the mesh is wraparound and the method comprises wrapping the mesh around the pipe coatings so that the longitudinal edges of the mesh overlap. This configuration means that the mesh forms an electrical coil around the line coating, which coil is heated, together with the pipe, by the induction heater. Preferably the overlapping edges of the mesh overlap by 0.5 to 1.5 mm, especially by about 1 mm.

The method according to the invention preferably also includes the additional step of pre-heating the bared joint region with an induction heater. The coating will also be slightly heated during this process but not to the desired bond line temperature to achieve a good bond to the adhesive lined covering.

An especially preferred method according to the invention therefore comprises the following steps:

(a) prepare surface of joint according to the standard procedure;

(b) pre-heat bared metal joint region with induction heater coil;

(c) wrap metal mesh elements around ends of line coating on either side of bared joint region, so that longitudinal edges of each mesh overlap by about 1 mm to form an electrical coil;

(d) install a heat shrinkable sleeve, e.g. using a gas torch, to conform the sleeve and the adhesive to the shape of the joint and to ensure a good physical contact:

(e) post heat entire joint with induction heater to generate a high temperature (of say 200°C) not only between the bared pipe and the heat shrunk sleeve, but also between the line coating and the heat shrunk sleeve.

The frequency at which the induction heater is preferably used in the present invention depends inter alia on the pipe diameter and the thickness of the line coatings. For certain sizes and thicknesses the frequency is preferably operated in range 300-500 Hz especially about 400 Hz. Preferably the heater is in the form of a coil which comprises 10-20 wraps, especially about 16 wraps. Preferably the heater is about 700-900 mm long especially about 800 mm long. It preferably has a maximum output of about 500-700 Amps, especially about 600 Amps.

A major advantage of the present invention is that a single post heating step (by induction) heats the entire bond line surface under the heat recovered sleeve to the desired bond line temperature (of about 80°C to 200°C, preferably 100°C to 150°C, depending on the material at the bond line, and no additional apparatus is required.

An advantage of the preferred method, where pre-heating by induction is also used, is that a single apparatus (the induction heating coil) is simply and conveniently used for both the pre- and post heating steps of the preferred method.

An embodiment of the present invention will now be described, by way of example ,with reference to the accompanying drawings, wherein:

Figures 1 and 2 are part sectional views, and Figures 3 and 4 are sectional views showing sequential stages in a method according to the invention. Referring now to the drawings Figure 1 shows two steel pipes 2 welded at bead 4. Each of the pipes 2 is covered with a line coating 6 comprising polyethylene. The polyethylene

line coating 6 has been cut back in the region of weld 4, prior to the welding operation. Figure 1 shows the first step according to the invention in which an induction heating coil 7 is placed around the joint region, and activated to pre-heat the joint region. The induction heating coil comprises 16 wraps (not shown in full in the drawings) and operates at a frequency of 400 Hz. The pre-heating temperature generated by the induction heater is 200°C on surface of the bare steel pipe 2, and about 90°C on the surface of the polyethylene line coating 6.

Turning now to figure 2, the next step involves removing the induction coil 7 (or moving it to one side), and positioning metallic meshes 8, over both line coatings on either side of the bare joint region. This stage of the method also comprises positioning an adhesive lined sleeve 10 (with adhesive 12) to overlap the bare joint region, and also to overlap the metal meshes 8 and underlying line coating 6. This heat shrinkable sleeve 10 is then heated, preferably with a gas torch, to shrink it into conformity with the shape of the joint and to ensure good physical contact between the adhesive lined sleeve and the underlying bared steel pipes 2, weld bead 4, and metal meshes 8 and line coating 6.

Figure 3 shows the sleeve of Figure 2 after heating by gas torch to shrink it into conformity with the underlying substrate.

The last step in the method is shown in Figure 4 in which the induction heating coil 7 is returned in place over the joint and shrunk sleeve. The heating coil is activated again. This time not only the bare steel pipes 2, but also the metal meshes 8 are heated by the induction heating coil 7. The effect of this is that not only the bare steel pipe 2 is heated to a temperature of about 200°C, but also the metal meshes 8 at the interface between the line coating 6 and the adhesive lined sleeve 10, 12 are also heated to that temperature. The heating causes a fusion bond to form, through the apertures in the mesh 8, between the adhesive 12 and the line coating 6 on the pipe. A good bond between the adhesive 12 and the steel pipe 2 is also achieved by the heating.

Claims

1. A method of covering a joint between coated metal pipes which have been bared of coating in the joint region, comprising positioning an adhesive lined heat recoverable covering over the bared joint region so that it overlies the coating on either side thereof, heating the covering to cause it to recover into conformity with the underlying joint and coating, and after recovery of the covering applying induction heating to the covered joint, characterised in that prior to recovery of the covering:

   (i) a metallic element is positioned over the coating on either side of the bared joint region; and

   (ii) the heat recoverable covering is positioned so that it overlies both of the metallic elements.

2. A method according to Claim 1, wherein the heat recoverable covering is in the form of a sleeve or a tape.

3. A method according to Claim 1 or 2, wherein each metallic element is apertured, and is preferably in the form of a mesh.

4. A method according to Claim 3, wherein the mesh is wraparound and the method comprising wrapping the mesh around the pipe coatings so that the longitudinal edges overlap.

Fig.1.

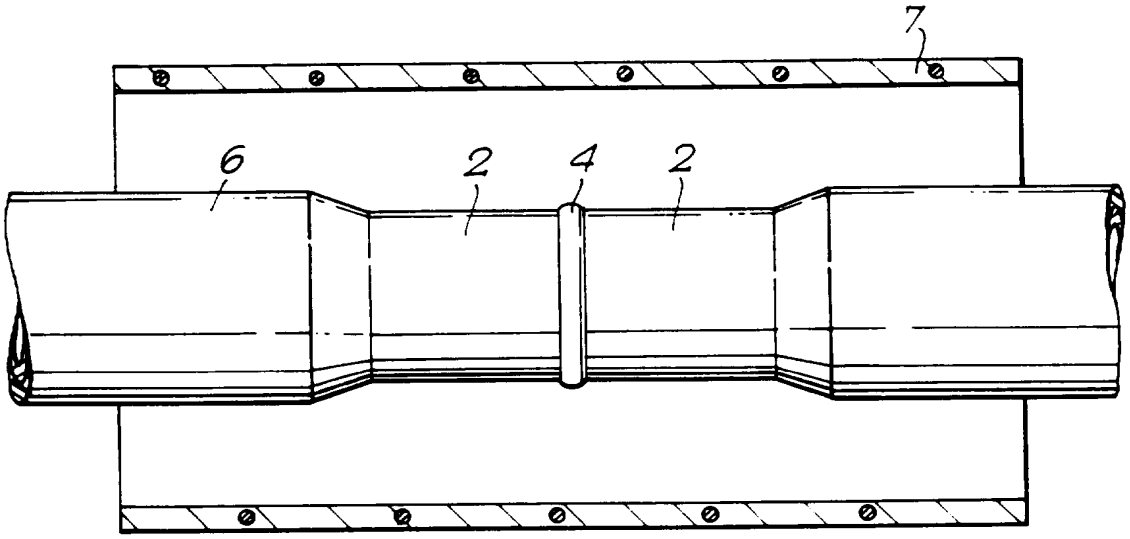


Fig.2.

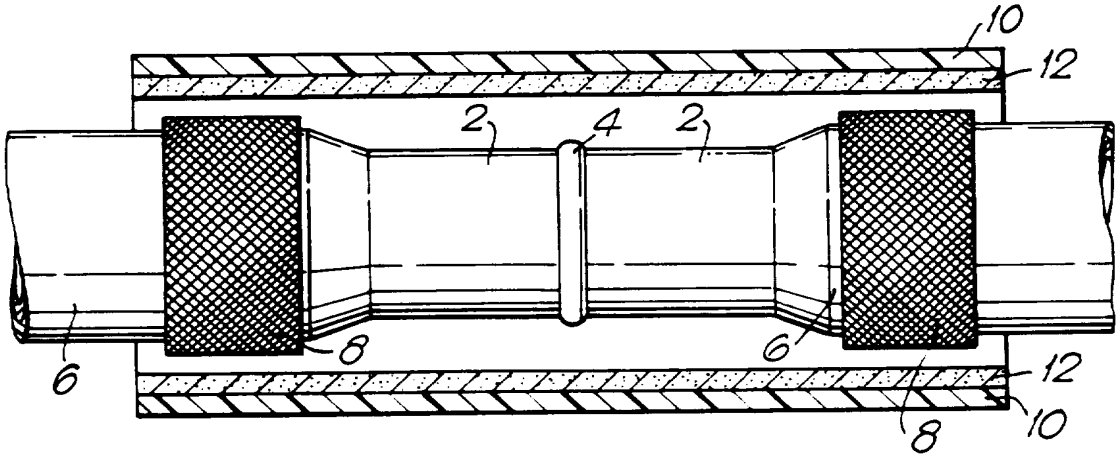


Fig.3.

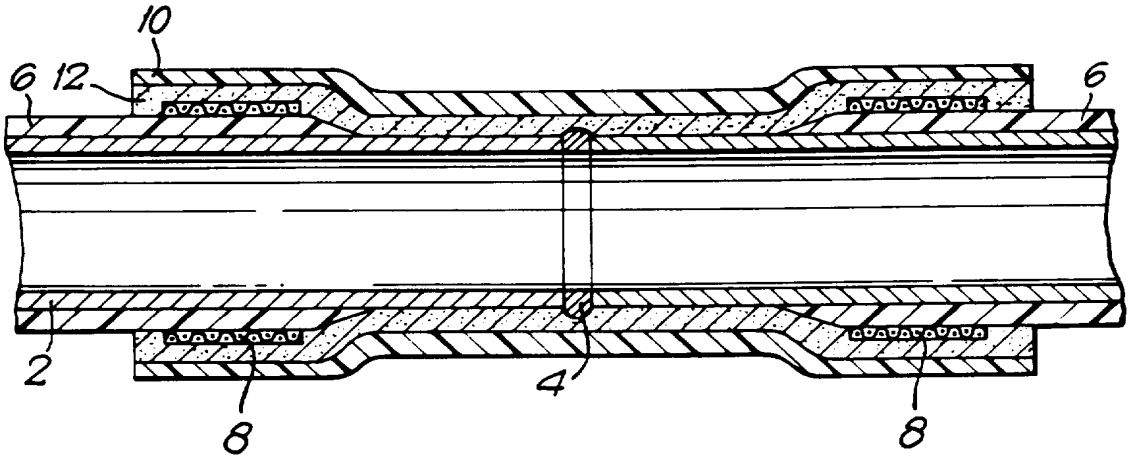
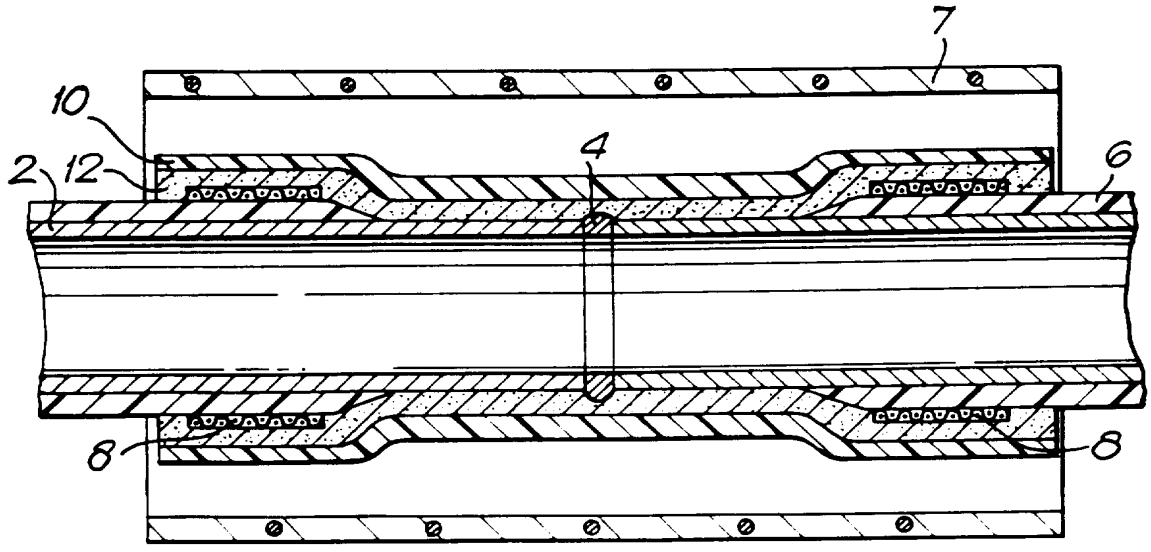


Fig.4.



INTERNATIONAL SEARCH REPORT

Inte onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F16L47/00 F16L47/02 F16L59/20 B29C61/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F16L B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,37 20 577 (MEIER-SCHENK AG) 4 February 1988 see the whole document ---	1-4
X	DE,C,32 26 575 (STEINZEUG- UND KUNSTSTOFFWERKE FRIEDRICHSFELD GMBH) 1 March 1984 see the whole document ---	1-4
X	FR,A,2 594 379 (KABELMETAL ELEKTRO GMBH) 21 August 1987 see the whole document ---	1-4
X	WO,A,84 03346 (VAN DER WIEL) 30 August 1984 see the whole document ---	1

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A	GB,A,1 435 695 (PIPE CONDUITS LTD) 12 May 1976 see page 2, line 70-112; figures 1,2	1,2

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Information on patent family members

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